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THE ACQUISITION OF ENGLISH PAST TENSE IN BILINGUAL CHILDREN

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THE ACQUISITION OF ENGLISH PAST TENSE IN BILINGUAL CHILDREN

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The Acquisition of English Past Tense in Bilingual Children

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This study investigated the role of cross-linguistic influence in the production of verb morphology by comparing two bilingual groups from distinct L1 backgrounds, one with rich inflectional morphology (i.e., Spanish), and the other lacking grammatical morphology (i.e., Mandarin). 20 Spanish-English bilinguals, 20 Mandarin-English bilinguals, and 20 English monolingual peers, aged 3-4 years, completed a picture elicitation task, in which they were prompted to produce past tense forms of 40 regular and irregular verbs.

We addressed the following questions: (1) Is past tense production accuracy comparable across the three language groups? (2) Do verb frequency and regularity influence past tense production in monolinguals and bilinguals? (3) What error patterns do monolinguals and bilinguals exhibit? Mandarin-English bilingual children were less proficient at producing English past tense than both English monolingual and Spanish-English bilingual peers. The group effect on overall accuracy, however, was moderated by verb regularity, with comparable odds to produce target forms between the two bilingual groups for irregular verbs. There was also a group difference in error patterns.

The English monolinguals and the Spanish-English bilinguals were more likely than the Mandarin-English bilinguals to overregularize past tense markers, whereas the Mandarin-English speakers were more likely to produce bare stems of the verbs. This study yielded suggestive evidence of cross-linguistic transfer in tense morphology acquisition in young bilingual children. As an important and effective clinical marker for language impairment, verb morphology needs to be considered with language backgrounds for accurate assessment in bilingual children.

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Chapter One: Introduction

Every language has a way to talk about time. Temporal expressions are prevalent across languages and relevant to linguistic and cognitive processing. As a result, the ability to mark temporal relationships is important in language development. For bilingual children acquiring English as their second language, learning past tense is potentially challenging. Compared with their monolingual peers, bilingual children are usually less accurate with past tense marking and experience a slowdown in their developmental pathway (e.g., Nicoladis, Palmer, & Marentette, 2007). As their age increases and language experience accumulates, bilingual children may achieve similar linguistic competence as their monolingual counterparts, if English is their dominant language.

Many factors are associated with the acquisition of English past tense in bilinguals, including the linguistic properties of the input languages (e.g., Nicoladis et al., 2007; Paradis, 2010), and participant demographic characteristics (e.g., Jia & Fuse, 2007; Chondrogianni & Marinis, 2012). Whereas linguistic and experiential variables have been well documented, the influence from the other language on bilingual children's English grammatical performance merits more attention. With mixed evidence for and against the impact of the other language on bilingual children's grammatical performance (e.g., Gutiérrez-Clellen, Simon-Cereijido, & Wagner, 2008; Nicoladis, Song, & Marentette, 2012), the role of cross-linguistic influence in past tense acquisition is yet to be established. One way to investigate how different L1 past tense marking systems impact

L2 past tense marking systems is to compare two young bilingual groups from L1s which differ in verb morphology. Nicoladis and colleagues (2012) reported that two bilingual groups with different L1s (e.g., French, Mandarin) might have similar accuracy in L2 past tense marking, but demonstrate different patterns of errors. Influence from L1, or cross-linguistic influence, is believed to be the main factor that causes the variations.

In the present study, we set out to profile and compare English past tense marking systems in two young bilingual groups (Spanish-English, Mandarin-English) and their English monolingual counterparts aged between 3-4 years. The two languages vary in the extent to which they overtly mark tense. Spanish has relatively rich and flexible morphological expressions for tense compared with English (e.g., Bedore, 2001) whereas Mandarin Chinese has no grammatical markers for tense (e.g., Li & Thompson, 1989). These two pairs, Spanish-English vs. Mandarin-English, one with tense marking systems in both languages, and one with tense marking systems only in one language, provide a natural contrast in L1 features in corresponding bilingual groups. By comparing Mandarin-English and Spanish-English bilingual children in their English past tense production, we can verify experimentally if there are differences between accuracy and error types. If the two bilingual groups demonstrate variations in their past tense use, we may investigate whether the variations can be attributed to cross-linguistic influence.

We begin by describing and comparing tense-aspect linguistic systems in English, Spanish, and Mandarin, with an emphasis on past tense. Next, we review studies on the development of tense markers in monolingual and bilingual populations. For bilingual

populations, our focus is on the relationship between the acquisition of tense markers and several factors including language use, vocabulary proficiency, and parental language proficiency. For comparisons between monolinguals and bilinguals, we examine accuracy and error patterns when these populations acquire past tense. Finally, we discuss how cross-linguistic influence may affect the acquisition of tense morphology.

TENSE-ASPECT MORPHOLOGY IN ENGLISH, SPANISH, AND MANDARIN

Time, as an invisible concept, is often expressed and understood via linguistic representations by people in a community. Temporal relations are conceptualized and encoded by means of morphology (e.g., tense-aspect markers) and/or lexical devices (e.g., adverbs) that are associated with verbs of perceptible actions, situations, and experiences.

In English, tense markers indicate the past (the regular -ed, e.g., "laughed," or irregular, e.g., "came"). Regular and irregular inflection are two ways of marking past tense. Regular verbs are inflected by adding the past tense morphology –ed. When the verb ends in /d/ or /t/, the ending is pronounced as /Id/ or /əd/. When the verb ends in a voiced sound other than /d/, the ending is pronounced as /d/. When the verb ends in a voiceless consonant other than /t/, the ending is pronounced as /t/. In contrast to the consistent manner of regular verb inflection, irregular verbs do not take on the –ed ending. Instead, irregular past tense forms often exhibit changes in the stem including vowel changes (e.g., sing-sang; run-ran), blends of vowel and consonant changes (e.g., feel-felt; leave-left), new forms (e.g., go-went), and no change (e.g., hit-hit; hurt-hurt).

Note that many irregular verbs are high-frequency words in English (Taatgen & Anderson, 2002).

In comparison with English, Spanish is a highly inflected language and has a relatively rich morphological system (Bedore, 2001), in which verbs are distinctively marked for tense, aspect, person and number. For example, verbs of three regular endings (-ar, -er, -ir) are inflected differently for person and number in preterite tense. Table 1 illustrates the different regularly conjugated forms for the three ending types using the exemplars hablar [talk], comer [eat], vivir [live] (English glosses are included in the brackets). Spanish past tense is marked by a rich set of suffixes (e.g., -é, -aste, -í, -iste). Because these suffixes are full syllabic forms and stressed, they are relatively salient, when compared with the regular English past tense ending –ed (e.g., [t] in talked; [d] in lived; and [id] in visited). A number of Spanish verbs are irregular in the preterite. Their stems change in addition to their endings (estar [be] in Table 1 as an example).

Table 1

Spanish regular verb form conjugation

	hablar (talk)	**comer (eat)**	**vivir (live)**	**estar (be)**
yo (I)	Hablé	comí	viví	estuve
tú (you, single)	Hablaste	comiste	viviste	estuviste
él/ella (he/she)	Habló	comió	vivió	estuvo
nosotros (we)	Hablamos	comimos	vivimos	estuvimos
ellos/ellas/Ustedes (they, you plural)	Hablaron	comieron	vivieron	estuvieron

The temporal sequence of an event in Mandarin is often indicated by discourse cues (e.g., chronological order, context) or adverbial expressions (e.g., 昨天 zuotian [yesterday], 然后 ranhou [then]) (Yang & Huang, 2004) rather than inflectional markers. Comparable discourse and adverbial cues are also used in Spanish and English. As a "tenseless" language, Mandarin has a rich aspectual system with several aspect markers (perfective markers: le, guo; imperfective markers: zai, zhe). Mandarin verbs undergo no morphophonemic inflections and may be immediately followed by aspect markers which are usually grammatically optional (e.g., 昨天我接到一封信 zuotian wo jiedao yi feng xin [Yesterday I receive one CLASSIFIER letter] and 昨天我接到了一封信 zuotian wo jiedao le yi feng xin [Yesterday I receive ASPECT one CLASSIFIER letter] can be used interchangeably). There are some syntactic or pragmatic contexts in

which an aspect marker is not obligatory but is strongly preferred. In general, a key difference between Mandarin and English or Spanish with respect to temporal marking lies in the fact that Mandarin does not have temporal grammaticalized morphemes.

Taken together, English, Spanish, and Mandarin have similarities and differences in the linguistic realization of temporal concepts. Both English and Spanish require verb morphology marking tense and aspect, whereas Mandarin has optional aspect markers and lacks grammatical markers for tense. Therefore, Spanish or Mandarin learners of English may face different challenges when acquiring L2 past tense morphology. Spanish learners may readily observe and map the past tense concept with the corresponding English morphological ending –ed, because inflectional morphology is also used to express past tense in Spanish. Nevertheless, Spanish learners may find English past tense marking relatively non-salient, as the –ed ending has a short phonological realization and is grammatically less complex. Moreover, Spanish speakers likely do not have an advantage over Mandarin speakers with respect to English irregular verbs acquisition. Instead, overregularization is likely to occur if Spanish speakers rely excessively on the morphological rules. In contrast, Mandarin learners may not be able to refer to L1 for knowledge of past tense forms and transfer the knowledge readily to English, as Mandarin has no grammaticalized markers for tense. Mandarin aspect markers may help Mandarin learners of English gain some awareness of temporal marking. However, such influences may be restricted, as Mandarin aspect markers are optional in many contexts. With less competition from the L1 tense-aspect system, Mandarin learners may be less

likely to produce overregularization errors relative to their English monolingual counterparts and Spanish learning peers.

ACQUISITION OF TENSE MORPHOLOGY IN MONOLINGUALS AND BILINGUALS

Monolinguals: Accuracy, error patterns and influencing factors

Time-related grammatical morphemes are acquired early by children. In English, studies of monolingual tense acquisition have focused on age of onset of morpheme use, age of mastery of different morphological markers, and the sequence of acquisition. For example, Brown's study of grammatical morpheme acquisition by English monolingual children showed that typically-developing English monolinguals master regular past -ed between 26-48 months and some irregular verb past tense forms (e.g., came, fell) are mastered between 25-46 months (Brown, 1973; Owens, 1984). Children usually go through a stage in which they produce developmental errors such as over-regularization or omission of verb grammatical morphemes in obligatory contexts. By the time that children enter kindergarten at around 5 years of age, they have reached a high level of accuracy in using these grammatical morphemes in spontaneous speech. The most common error type for English monolinguals is overregularization (Marcus et al., 1992).

In Spanish, studies on verb morphology emergence showed that past tense is among the earliest learned forms. Kvaal, Shipstead-Cox, and Nevitt (1988) examined the use of regular and irregular preterite forms in the spontaneous language samples of Spanish monolingual children. Children who reached 2 years old or had an MLU of 2.6 used regular preterite forms productively. Children who were 2;4 (years;months) with an

MLU of 2.8 produced regular preterite forms with over 80% accuracy. They also found that irregular preterite forms were acquired later than regular preterite forms, in their study at the age of about 3 years old with an MLU of 4.6. Phonetic salience may facilitate auditory perception and promote the early production of these forms in Spanish. Therefore, the use of past tense occurs earlier in Spanish than in English (Bedore, Cooperson, & Boerger, 2012). Alternatively, the early occurrence of past tense in Spanish may be attributed to the language's rich inflectional system. As previously suggested by a study with English and Italian monolingual children (Devescovi, Caselli, Marchione, Pasqualetti, Reilly, & Bates, 2005), a relatively richer inflectional system might lead to the earlier conception of grammar awareness involving regularities.

In the domain of aspectual acquisition in Mandarin monolingual children, a longitudinal study by Erbaugh (1992) collected naturalistic speech of four Mandarin-speaking children from the age of 1 to 3. It was found that by the age of 3, these children could correctly use the four aspect markers (le, zai, zhe, guo). As a group, these findings suggest that, by the age of four, monolingual children should start to reliably mark tense-aspect relationships.

Verb regularity and verb frequency influence English past tense acquisition. For example, Rice and Wexler (2001) reported that 3-4-year-old English monolinguals had higher accuracy with regular verbs than irregular verbs. Regular and irregular forms are also thought to be linked with different learning strategies. One theory considers regular verb inflection as a rule-based learning process, whereas irregular verb form production

as purely lexical memorization (e.g., Pinker & Ullman, 2002). Strategies for regular and irregular verb learning are further associated with opportunities to hear verbs and their past tense forms. In general, the more frequently a past tense form occurs in the input, the more likely it is to be mastered by children at an early age. For regular verbs, listening to different verbs inflected in a similar way for English past tense facilitates generalization of the rule of adding –ed. However, some irregular past tense forms (e.g., came, fell, broke, sat, went) are of high frequency in the speech of parents interacting with their children and are often acquired before regular past –ed (e.g., Brown, 1973; Owens, 1984). With regard to the role of frequency on monolingual past tense use, patterns of past tense marking as a function of frequency were documented in a body of research, which investigated learning processes and mechanisms (e.g., Marchman, 1997; Marchman, Wulfeck, & Weismer, 1999; Oetting & Horohove, 1997; Rice, Wexler, Marquis, & Hershberger, 2000). For example, Marchman et al. (1999) reported that children displayed difficulties with low frequency verbs and were more likely to either overregularize or omit past tense marking in low frequency verbs.

Lexical proficiency is also relevant to the acquisition of English tense morphology. The relationship between early lexical and grammatical development has been documented in children from different linguistic backgrounds (e.g., English: Devescovi et al., 2005; Spanish: Mariscal & Gallego, 2012; Cantonese: Chan, 2000). Because of the lexicon-grammar relationship, some scholars have recommended using vocabulary size as the basis for group matching in comparative studies of grammar

development (e.g., Devescovi et al., 2005; Mariscal & Gallego, 2012). The critical mass hypothesis (e.g., Marchman & Bates, 1994; Plunkett & Marchman, 1996) further describes how vocabulary and grammar are interdependent in English. The hypothesis is that accumulating vocabulary to a certain extent was one of the contributing factors for morphological rule acquisition (e.g., past tense marking). Other evidence supporting this hypothesis included the fact that children usually did not overregularize verbs (e.g., "teached" instead of "taught") when their vocabulary was small (Marcus et al., 1992). However, the majority of research revealed that the association between lexical and grammatical development in English was found only for very young children (e.g., Devescovi et al., 2005: 1;6 - 2;6). Some studies with other languages suggested that the impact of vocabulary growth on grammar development was not evident in children older than 3 years old (Mariscal & Gallego, 2012), or in children with MLU longer than about 3.7 (Chan, 2000).

Bilinguals

Accuracy

Research on bilingual past tense marking indicates a general lag behind monolingual performance. For example, Chondrogianni and Marinis (2012) compared overall past tense accuracy in 39 sequential Turkish-English bilinguals who had been exposed to English for more than 3 years and 28 age-matched English monolinguals. They reported significantly poorer performance in the bilingual production of past tense – ed. Similarly, Nicholls, Eadie, and Reilly (2011) investigated English morphological

abilities in 72 3-year-old bilinguals from different L1 backgrounds in Australia and compared their performance with 72 English monolingual counterparts. As a group, bilingual participants demonstrated lower accuracy in past tense marking than their monolingual peers, for both regular and irregular verb inflections.

Several other studies confirmed this overall delay in bilinguals, but suggested that bilinguals had different accuracy levels for regular and irregular verbs. For example, Rispens and de Bree (2015) found that seven-year-old Dutch-Hebrew bilingual children and their Dutch monolingual peers were on par with respect to regular past tense use, but monolingual children were more accurate in irregular forms. In another study, Nicoladis et al. (2007) made comparisons in the use of past tense between simultaneous French-English bilinguals (aged 4-6) and their monolingual peers in both English and French. Results suggested a lag in bilinguals. Moreover, they found that bilingual children were more accurate with regular forms than irregular forms in both languages. Paradis, Nicoladis, Crago, and Genesee (2011) reported similar findings which indicated a higher accuracy rate with regular verbs as opposed to irregular verbs in both French-English bilingual and French monolingual groups. Moreover, past tense use was sensitive to language input level in bilingual children, with relatively more English input linked with lower accuracy level for French regular and irregular verbs.

Error patterns

Some studies with bilingual populations showed that bilinguals might produce different primary error types when compared with monolinguals (e.g., Jacobson & Livert,

2010; Jacobson & Schwartz, 2005), whereas other studies suggested no such monolingual-bilingual differences (e.g., Nicoladis et al., 2007). Error patterns may also differ between bilingual groups as shown by Nicoladis and colleagues (2012). They conducted a study with Chinese-English and French-English bilinguals aged between 5 and 12 years old, asking them to recount stories after watching a video cartoon. Although the two groups performed similarly with regard to overall accuracy on past tense usage, errors made by these two bilingual groups varied in type. Specifically, when they made errors in obligatory regular or irregular past tense marking contexts, Chinese-English bilinguals preferred verb stems, whereas French-English bilinguals were likely to use present tense with regular verbs, and overregularized forms with irregular verbs, similar to English monolingual children.

The possible underlying cause of the discrepancies in the error patterns provided insight into the influence of L1. Both English and French have regular and irregular verb inflections and both languages mark tense. But there is no tense marker and no regular/irregular verb distinction in Mandarin. Therefore, children acquiring French as L1 may be more ready to conjugate verbs when they learn English. In contrast, it may take a prolonged time for children whose L1 is Mandarin to develop the concept of tense marking. Before they are able to apply the conjugation rules with high accuracy, they may produce irregular verbs accurately due to memorization. Therefore, the contrasting error patterns may be attributed to the different L1 backgrounds of the two bilingual groups. However, the participants in this study produced different verbs in their

narratives, and the analyses were therefore based on verbs which might differ in semantic features. Because characteristics of verbs (e.g., telicity) might affect tense-aspect marking, it is possible that the discrepancy may be partly due to the different sets of verbs in the two bilingual groups' narratives. To rule out this possibility, controlling for verb types in the analyses would have been useful.

Influencing factors

In addition to the linguistic factors that influence past tense acquisition, differences in bilingual experience may impact acquisition of tense. Quantitative and qualitative features of language use, such as current language use (e.g., Bohman, Bedore, Peña, Mendez-Perez, & Gillam, 2010), and parents' English proficiency (e.g., Chodrogianni & Marinis, 2011) have been identified as possible factors.

Amount of language experience. The usage-based theory (e.g., Tomasello, 2003) pointed out that the acquisition of tense-aspect grammatical structures was sensitive to the frequency and consistency of the structure in the input. Bilingual children in the process of acquiring two linguistic systems have less exposure to each language in comparison to monolingual peers. Therefore, with less frequent and less consistent input, bilingual children are likely to demonstrate different and often lower accuracy compared to monolinguals with regard to tense-aspect morphology. In a study with French-English bilinguals, overall English past tense use (regular and irregular) by bilingual children (aged between 4 and 5) was significantly less accurate than for English monolingual peers (Paradis et al., 2011). Of these bilingual children, those with relatively more input

in one language were more accurate than those with relatively less input. This study, together with others (e.g., Bedore, Peña, et al., 2012; Nicoladis et al., 2007; Gathercole, 2007), supported the usage-based theory and showed that different amounts of exposure to languages had an impact on the accuracy of morphological structures in bilingual language acquisition. However, Chondrogianni and Marinis (2011) showed that tense morphological acquisition was not as susceptible to input factors as vocabulary and complex syntax. They suggested that input factors were not a predictor of past tense use, probably because their participants (with a mean age of 7 years) were generally highly accurate with past tense marking. The small variation in their performance led to a non-significant relationship between input and accuracy.

Parental language proficiency. Some researchers contend that input quality is as relevant as input quantity to bilingual development (e.g., Paradis, 2011). With regard to English past tense acquisition, input quality may refer to the accurate inflection of regular verbs with –ed, and correct production of irregular forms in the language directed to children. Unless enrolled in bilingual or immersion programs, bilingual children receive similar language input as English monolinguals in school settings. However, there are good reasons to expect variations in English input quality in the after-school environment, especially for children whose parents are first-generation immigrants. These parents were generally late learners of English and arrived in the United States in their adulthood. They were less likely to achieve native-like proficiency in L2 (e.g., Mandarin-English bilingual adults: Jia & Aaronson, 2003; Jia, Aaronson, & Wu, 2002;

Spanish-English bilingual adults: Montrul, 2002). As a result of bilingual adults' non-native English proficiency, they are likely to make more speech errors than English monolinguals. For example, Jacobson and Cairns (2008) collected individual reports from Spanish-English bilingual adults to investigate the linguistic features of the environmental input available to bilingual children. The majority of the participating bilingual adults acknowledged hearing and using overregularizations and other incorrect inflections of regular verbs. Such variant language use was less frequently observed in the monolingual adult input. The authors argued that the difference between monolingual and bilingual linguistic input might explain why children from these two language groups varied in how likely they accepted the ungrammatical forms.

Lexical proficiency. Similar to monolinguals, the correlation between vocabulary and grammar in bilingual toddlers is strong (e.g., Marchman, Martínez-Sussmann, & Dale, 2004). Moreover, Marchman and colleagues (2004) found that the lexicon-grammar associations occurred only within a language for these simultaneous Spanish-English bilinguals. Grammatical skills in one language (e.g., English) and vocabulary size in the other language (e.g., Spanish) were only weakly related. Nevertheless, the link between tense acquisition and vocabulary development in bilingual children has not been widely studied and remains unclear. The inherent characteristics of verbs (regularity, frequency) also have an influence on past tense acquisition in bilingual populations. For example, there were differences between regular and irregular verbs with regard to production accuracy in French-English bilingual children's narratives (e.g., Paradis,

2010; Paradis et al., 2011). These bilingual children produced regular verbs with higher accuracy in both languages. Some studies also show the intricate relationships among vocabulary, regularity and frequency. For example, in a study which investigated the production of Dutch past tense (Rispens & de Bree, 2015), 7-year-old Dutch-Hebrew bilingual children were as proficient as age-matched monolinguals at regular past tense marking, but marked irregular past tense at a similar accuracy as the 5-year-old monolinguals who were matched on receptive vocabulary with the bilingual group.

Cross-linguistic influence. Studies focusing on cross-linguistic influences have showed that the acquisition of the L2 tense system might be influenced by the learners' L1. For example, Jia et al. (2002) compared the performance between adult Asian language (Mandarin, Cantonese, Korean) speakers and adult European language (Russian, Spanish, Haitian, Creole, Polish, German, and Italian) speakers in an English (L2) grammaticality judgment task. Several English morphosyntactic structures (e.g., plurals, word order), in addition to time-related grammatical markers, were tested. The Asian language group had lower overall accuracy than the European language group in both English listening and reading tasks. With respect to past tense marking, the Asian language group attained 90% accuracy in the listening task, whereas the European language group achieved 98%. Although the two groups had comparable accuracy of past tense marking in the reading task, age of acquisition was significantly correlated with accuracy levels in the Asian language but not the European language group. The authors argued that the differences might be partly due to contrasting L1 attributes, because many

of the European languages were linguistically closer to English than the Asian languages. Another study with simultaneous bilinguals of English and Mandarin in Singapore (Brebner, McCormack, & Liow, 2016) reported that some bilingual kindergarteners, who were Mandarin-dominant according to parental report, did not produce English tense morphemes in an elicitation task. Given that these children had received three years of schooling in English, the authors suggested that the absence of English tense marking might be attributed to the lack of morphological and phonological changes in Mandarin verbs.

The relationship between a child's L1 and the development of L2 is addressed by some prominent models of bilingual acquisition. The linguistic interdependence hypothesis by Cummins (1979) purports that linguistic proficiency, especially academic and cognitive development, is shared and interdependent across L1 and L2, despite the differences in their surface structural features. Another important model, the Unified Model (MacWhinney, 2005), provides a general framework for understanding the process of positively and negatively transferring knowledge in different domains from L1 to L2 and vice versa. Positive transfer occurs when two languages share similar concepts and linguistic forms including phonological, lexical, and morphosyntactic systems, whereas negative transfer may be predicted by the opposite circumstance. According to the model, transfer is likely to occur in some areas (e.g., conceptual level, pragmatic level), but not others (e.g., morphology). According to assumptions in the Unified Model, the concept of time and functions of temporal adverbial devices may be transferred from Mandarin to

English. However, in the process of acquiring English, there may be no cross-language transfer with regard to tense morphology because Mandarin and English share no common basis for tense morphology transfer. In contrast, when Spanish speakers start to learn English, they may have already developed a general awareness of tense morphological marking, as the morphology is present in their L1. Therefore, Spanish-English bilinguals may be likely to mark a verb with tense morphology.

Summary. Taken together, many factors are involved in bilingual past tense acquisition. With typological distinctions, variant language experience, and different proficiency levels, the interactions between Mandarin and English temporal linguistic systems are predicted to be complex. When studying the impact of L1 (e.g., Spanish, Mandarin) tense systems on L2 (e.g., English) past tense development, we need to manipulate the verbal features (e.g., regularity, frequency), and isolate cross-linguistic influence from other factors which play a role in the process of bilingual past tense acquisition (e.g., language use, parental English proficiency, lexical proficiency).

THE CURRENT STUDY

The primary goal of the current study is to enhance our understanding of interaction and interference in bilingual linguistic systems. To this end, we employed an elicitation task in which participants are prompted to produce verbs or verb phrases in past tense contexts. We aim to focus on the effect of cross-linguistic influence and separate this effect as much as possible from other factors shown to have an impact on past tense marking by (1) recruiting participants with distinct L1 backgrounds in terms of

past tense marking; (2) matching participant demographic backgrounds including age, English language use, and socioeconomic status or SES; and (3) manipulating target verb stimulus features. Moreover, in-depth analyses and comparisons of the non-target productions between bilingual groups and between bilingual and monolingual groups should provide robust evidence for the influence of L1 past tense usage on L2 verb morphology. We asked the following specific research questions:

1. Do bilingual and monolingual groups have comparable levels of overall past tense production accuracy?
2. Do verb frequency and regularity influence past tense production in monolinguals and bilinguals?
3. What types of errors with regard to past tense marking do monolinguals and bilinguals produce? Do they demonstrate similar error patterns?

Given the role of input amount in morphosyntax acquisition (Bohman et al., 2010) and the impact of input pattern on tense acquisition (e.g., Shirai & Andersen, 1995; Chen & Shirai, 2010), we predicted that bilinguals would show slight lags relative to their English monolingual peers in past tense marking due to reduced opportunities to hear and practice each language. Moreover, we hypothesized that Mandarin-English bilingual children would have lower overall production accuracy than Spanish-English bilingual children, at least for regular verbs. The absence of tense markers in Mandarin might be a possible factor which led to Mandarin-English bilinguals' inferior performance in tense marking in comparison with Spanish-English bilinguals and English monolinguals, as

Mandarin-English bilinguals could not use Mandarin past tense marking systems as a basis for learning the past tense morphology in English.

With regard to the effects of verb features, we predicted that the three language groups would be more accurate with high frequency verbs than low frequency verbs. In line with usage-based theory, the acquisition of morphosyntactic structures was sensitive to the frequency of the structures in the input language (Lieven & Tomasello, 2008; Tomasello, 2003). Moreover, it was anticipated that Mandarin-English bilinguals would be more likely to be accurate with irregular verbs than regular verbs, whereas Spanish-English bilinguals and English monolinguals would demonstrate the reverse pattern. Because tense morphologies are present in both English and Spanish, but not in Mandarin, a keen sense of the obligatory role of past tense morphemes and conjugations might be developed in English monolingual and Spanish-English bilingual children earlier than Mandarin-English bilingual children. By contrast, English irregular verbs mainly depend on their frequency in the input language, and some irregular past tense words are acquired in early ages preceding regular past tense marking (Brown, 1973). Therefore, Mandarin-English bilingual children would be as accurate Spanish-English bilingual and English monolingual counterparts in irregular past tense marking.

Based on the existing literature, there would be several types of errors in the bilingual and monolingual productions, including (1) overregularization (e.g., "*He runned back home in the rain*."); (2) Bare stem (e.g., "*He work late yesterday*."); (3) Stem+ing (e.g., "*He running back home in the rain*."); (4) Double marking (e.g., "*He*

ranned back home in the rain."); (5) Tense substitution (e.g., "*He runs back home in the rain*." in response to "*what did he do*?"); (6) others (e.g., no responses or "*I don't know*."). The primary tense-related error type for English monolinguals and Spanish-English bilinguals was overregularization (Marcus et al., 1992). Mandarin-English bilinguals might produce bare verb stem errors more frequently than overregularization. This prediction was based on the possible influence from L1. In Mandarin, verbs are not inflected for any grammatical categories including tense. Moreover, Mandarin perfective aspect markers are bound morphemes, inserted immediately after the verb to which they applied, and they are grammatically optional in many contexts. The prominent differences between the two languages' tense-aspect marking systems provide no basis for English past tense marking in Mandarin-English bilinguals. Therefore, young Mandarin-English bilingual children, whose single home language and input from birth was usually Mandarin, were likely to use bare stem forms in English, when adopting the same strategies in Mandarin and English past tense marking.

Chapter Two: Method

PARTICIPANTS

We recruited a total of 63 participants. These participants included 21 Spanish-English bilinguals, 22 Mandarin-English bilinguals, and 20 English monolinguals. All participants met the following criteria: (a) age between 3;0 and 4;11; (b) no history of any speech or language disorders or receiving communication interventions; (c) no report of hearing impairment; and (d) normal or correct-to-normal vision according to parental report. In addition to these criteria, bilingual participants were exposed to their L1 (Mandarin or Spanish) from birth and had systematic English input starting no later than 2 years of age.

One Spanish-English bilingual child and two Mandarin-English bilingual children were excluded from data analyses because they did not complete all the tasks within a testing session. The final data set consisted of 20 Spanish-English bilinguals (SE), 20 Mandarin-English bilinguals (ME), plus 20 English monolinguals (ENG) as the control group. 44 children (16 SE, 14 ME, 14 ENG) were tested in Austin, Texas. 16 children (4 SE, 6 ME, 6 ENG) were tested in Rochester, New York.

Participants' parents completed a questionnaire about their children's demographic characteristics before the testing session, and follow-up questions were addressed after child testing. Parents also rated their children's English proficiency in the areas of vocabulary, grammar, sentence length, pronunciation and listening comprehension. For each area, a score (ranging from 1 to 5) was given and an overall proficiency rating was obtained by averaging a child's scores of the five areas. A score of

one indicates low proficiency whereas a score of five represents high proficiency. In addition, parents of bilingual participants rated their children's L1 (Spanish/Mandarin) proficiency. To be included in the current study, bilingual participants must obtain 3.5 or higher in parental ratings for the better language's proficiency. The cut-off point of 3.5 was decided according to previous studies with Spanish-English bilingual children (Peña, Gutiérrez-Clellen, Iglesias, Goldstein, & Bedore, 2014) and Mandarin-English bilingual children (Sheng et al., 2016). Bilingual children's parents also responded to questions about their children's L1 (Spanish/Mandarin) schooling experience (Has you child ever been enrolled in a Spanish/Chinese language school or a Spanish-English/Chinese-English bilingual school?). In addition to bilingual children's information, parents also reported their own language use (e.g., What percentage of the time does the father communicate in English?), and rated their English communicative ability on a scale of 0-4 (0 indicates a lack of English communication skills; 4 indicates high proficiency in spoken English).

Finally, questions about children's hour-by-hour language experience on typical school weekday and weekend days were also included (Peña et al., 2014). The information was used to calculate the percentage of input and output in each language. Take the calculation of the input of a Mandarin-English bilingual child for example. Assume that her typical waking hours were 13.5 hours (e.g., from 7 am to 8:30 pm) per day. During weekdays, the time when the child heard only Mandarin was 1.5 hours (e.g., from 7 am to 8:30 am) per day, the time hearing only English was 8 hours (e.g., from

8:30 am to 4:30 pm) per day, and the time hearing both languages was 4 hours (e.g., from 4:30 pm to 8:30 pm). During weekends, the time hearing only Mandarin was 2 hours (e.g., from 8 am to 10 am) per day, the time hearing only English was 2 hours (e.g., from 10 am to 12 pm) per day, and the time hearing both languages was 9.5 hours (e.g., from 12 pm to 9:30 pm). When a child heard both languages within a period of time, the amount of time was evenly subdivided between the two languages. Therefore, the total waking hours of a week was 94.5 hours, the total amount of time hearing Mandarin during a week was 21hours, and the total amount of time hearing English during a week was 63.5 hours. Thus, the child received English input 67% of the time during a week. If a monolingual child had more than 10% current use of another language, the child was not be included in the English monolingual control group.

Table 2

Demographic characteristics of participants

	ENG (n=20)		SE (n=20)		ME (n=20)	
	M (*SD*)	Range	*M* (*SD*)	Range	*M* (*SD*)	Range
Child						
Age in month	51.2 (5.1)	37.6-59	51.7 (6.0)	41.6-58.8	51.7 (4.6)	44.3-59.8
Girls	n = 10		n = 14		n = 11	
English use[a] (%)	99 (24)	90-100	57 (19)	24-85	57 (14)	16-76
English rating	4.4 (0.3)	3.8-4.8	4.5 (0.4)	3.8-5	4.1 (0.5)	3.2-5
L1[b] rating	4.4 (0.3)	3.8-4.8	3.7 (0.8)	2.2-4.8	4.4 (0.5)	3.2-5
L1[b] schooling[c]	20		14		4	
Mother						
English use (%)	NA		67 (32)	10-100	37 (22)	10-99
English rating	NA		3.9 (0.9)	3-4	3.1 (0.6)	2-4
Education (years)	16.1 (3.8)	3-27	19.3 (8.2)	16-24	19.7 (3.6)	15-27
Father						
English use (%)	NA		69 (32)	0-100	46 (29)	10-100
English rating	NA		3.7 (0.7)	2-4	3.3 (0.5)	3-4
Education (years)	16.4 (4.0)	4-27	17.4 (5.6)	4-23	20.2 (3.4)	13-27

Note. [a] Mandarin/Spanish use = inverse of English use. [b] For ENG, L1 = English; for SE, L1 = Spanish; for ME, L1 = Mandarin. [c] L1 schooling = the number of children who received L1 education in school settings.

As shown in Table 2, the three groups were comparable in age, $F(2, 57) = 0.59$, $p = .94$. The age range was 3;2 to 4;11, and the mean age was 4;3. 14 SE children had been enrolled in a Spanish-English bilingual school or a Spanish immersion program. 4 ME children had attended a weekend Chinese class which helped children develop listening and speaking skills in Mandarin.

Results of a series of analyses of variance (ANOVAs)[1] showed a significant main effect[2] of language group (SE, ME, ENG) for parental rating of children's English, $F(2, 35.67) = 3.47$, $p < .05$, and English use, $F(2, 27.21) = 118.97$, $p < .00$. A post hoc Tukey test indicated that SE ($M = 4.53$, $SD = 0.37$) received significantly higher English proficiency rating scores than ME ($M = 4.14$, $SD = 0.54$); between ENG ($M = 4.40$, $SD = 0.28$) and either of the bilingual groups, however, English ratings were similar. With regard to language use, the two bilingual groups (SE: $M = 57\%$, $SD = 19\%$; ME: $M = 57\%$, $SD = 14\%$) did not differ in how much of the time they heard/spoke English. Both bilingual groups used significantly less English in daily life than ENG ($M = 99\%$, $SD = 24\%$). We also ran a one-way ANOVA to compare parental ratings of bilingual children's L1 proficiency. Results revealed that SE's Spanish rating ($M = 3.72$, $SD = 0.75$) was lower than ME's Mandarin rating ($M = 4.36$, $SD = 0.52$), $F(1, 38) = 9.83$, $p < .01$.

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[1] Statistical Package for the Social Sciences (SPSS), version 21.0 was employed for all data analyses in the current study.

[2] The assumption of homogeneity of variances was violated for parental rating of children's English and English use. Therefore we reported the Welch test results for these two variables.

The three groups also differed in maternal education, $F(2, 57) = 6.63$, $p < .01$, and paternal education, $F(2, 57) = 5.54$, $p < .01$. ENG's mothers ($M = 16.05$, $SD = 3.77$) had fewer years of education than the mothers of either of the bilingual groups (SE's mothers: $M = 19.31$, $SD = 8.24$; ME's mothers: $M = 19.70$, $SD = 3.56$). The fathers of ENG ($M = 16.40$, $SD = 3.97$) received fewer years of education than the fathers of ME ($M = 20.15$, $SD = 3.36$), but the fathers of ENG and SE ($M = 17.37$, $SD = 5.57$) had similar years of education. The two bilingual groups did not differ in maternal or paternal education. Bilingual children's parents were also asked to report their own language use and English proficiency. Compared with ME's mothers, SE's mothers reported higher English proficiency, $t(37) = -5.43$, $p < .001$, and greater English use, $t(37) = -3.59$, $p < .01$. The fathers of the two bilingual groups had comparable English self-ratings, $t(38) = -1.91$, $p = .06$, but the fathers of SE had greater English use than the fathers of ME, $t(37) = -2.35$, $p < .05$.

TASK AND STIMULI

Monolingual and bilingual children completed a 30-minute testing session consisting of the experimental past tense elicitation task and two control tasks, a phonological screening task and an action naming task. Each testing session began with the phonological screening task, followed by the past tense elicitation task and the action naming task. The action naming task was administered last because all target verbs in the elicitation task appeared in the action naming task. Giving the action naming last helped avoid familiarizing the children with the forms or priming children who responded using

one form of the verb (e.g., running) as a name to produce that non-targeted form in the past tense elicitation task. The whole testing session was audio-recorded. The three tasks are described below.

Phonological screening task

The purpose of this task was to ensure that children were able to produce final /t/ and /d/ in order to exclude the possibility of phonological processes affecting regular past tense production. Children were asked to imitate monomorphemic concrete nouns which end with /t/ or /d/. The instruction below was given at the beginning of this task:

"I am going to say some words. What you need to do is to listen carefully and say exactly what I say. Ready? Let's begin."

There were 10 exemplars in each of the two phonetic variations (e.g., bat, hat, cloud, gold, see a full list in Appendix A). The stimuli were presented in a fixed order across participants.

The scoring of this task focused on whether the child could produce /t/ or /d/ endings. The following imitations were considered acceptable: (1) producing the target ending sounds or phonologically consistent approximations (e.g., /kat/-/kat̚/; /bed/-/bed̚/); (2) using /t/ in place of /d/ as the final consonant, or vice versa (e.g., /kat/-/kad/; /bed/-/bet/); (3) mispronouncing consonants or vowels in positions other than the ending (e.g., /kat/-/gat/; /bed/-/bid/). The examiner also recorded all nontarget ending sounds. Scores on this task and mispronounced ending sounds were used as a reference when we interpreted results in the elicitation task. For example, if mispronunciations of /t/ or /d/

were consistent (e.g., /t/-/k/, /d/-/g/), elicitation task data with such mispronunciations would be reported and included for further analyses. If a child made no consistent mispronunciation and had a score below 10 (accuracy < 50%), his/her action naming and elicitation task data would be excluded due to phonological difficulties in using the target grammatical morpheme.

Elicitation task

This task was designed to tap children's ability to mark English past tense. The goal was to understand how frequency and regularity influence past tense production. The elicitation task was designed on the basis of the probes and stimuli used in Marchman et al. (1999), Marchman (1997), and Rice and Wexler (2001), where children listened to prompts such as "The boy is walking. He walks every day. Yesterday he _____" or "Here the boy is raking. Now he is done. Tell me what he did."

Stimulus verbs were classified as regular or irregular according to orthographic changes of the verbs. The past tense of a regular verb is formed by adding a -d (e.g., chase-chased) or an -ed (e.g., walk-walked) to the end of the verb, Sometimes the last consonant must be doubled (e.g., plan-planned) or the final "y" must be changed to "i" (e.g., carry-carried) before adding the -ed ending. These orthographic changes correspond to phonological changes, i.e., the addition of /t/ (e.g., /wərk/-/wərkt/, /d/ (e.g., /pul/-/puld/), or /əd/ (e.g., /want/-/wantəd/) to the final consonant or vowel of the verb. On the other hand, irregular verbs do not follow the consistent rule of -ed addition. There are multiple possibilities of irregular past tense forms. Orthographically, irregular past tense

may involve word-internal changes (e.g., drink-drank), anomalous changes (e.g., go-went), or no change (e.g., sit-sit). Phonologically, irregular verbs may experience a vowel change (e.g., /siŋ/-/sæŋ/, a consonant change (e.g., /build/-/built/), a combination of vowel and consonant changes (e.g., /fiːl/-/felt/), or no change (e.g., /put/-/put/). Moreover, the spelling of some irregular verbs remains the same in their past tense, but the pronunciation changes (e.g., read/riːd/-read/red/). The regular and irregular verbs selected in this study follow some of these changes in their past tense forms.

To obtain the frequency of the target verbs, we consulted the Hall, Nagy, and Linn (1984) corpus and used the language samples which were produced by nine white middle-class children aged between 4.5 to 5 years of age. The 2.5-hour spontaneous conversations of each child were recorded over two consecutive days in a variety of natural situations at home, at school and on the way to school. In this corpus, the white-middle class children used 3641 different words (type) and spoke a total of 82457 words (token). We did not include irregular verbs which have the same forms in the present and the past tenses (e.g., hit, hurt). In the current study, the raw frequency values for regular and irregular verbs were the occurrences of their present tense forms in the home, school and transition situations as a whole. The occurrences of these forms in the school setting alone were also listed as a reference because many bilingual children in the current study had a relatively higher proportion of English use at school than at home. On the basis of the number of occurrences, experimental items were categorized into high frequency versus low frequency within regular and irregular classes. An item was categorized as a

high frequency verb if the number of occurrences was equal to or greater than the median value for its verb class (i.e., regular or irregular). Similarly, an item was categorized as a low frequency verb when the occurrence number was less than the median value. For regular verbs, the median value was 11. For irregular verbs, the median value was 22.5.

We assigned stimuli to one of four orthogonal conditions on the basis of verb regularity and frequency: regular-high, regular-low, irregular-high, irregular-low. There were 10 items in each condition for a total of 40 items. Testing items were randomized such that no two items belonging to a single condition occurred consecutively. At the beginning of the task, children completed four practice trials (i.e., paint, fly, kiss, teach). The practice items provided answer models for children to follow. The practice items had drawings in a style similar to that of the experimental items and the elicitation script for the practice items was the same as for the experimental items. Only for these practice items, if the child gave correct answers, the examiner reinforced and repeated them. If the child gave nontarget responses, the examiner provided the target forms and asked the children to imitate the correct forms. For the testing items, the examiner said neutral prompts such as “Uh-huh” and “ok.” The practice items and testing items were presented in the same order to all children. Note that all the practice and testing targets in the elicitation task appeared in the action naming task, and the action naming task was given after the elicitation task. Following this order, we attempted to rule out the possibility that inaccurate English past use was due to children’s limited verb vocabulary.

To ensure that all target verbs were familiar to children, we selected verbs which were acquired at least 65% of the children at 30 months of age according to the MacArthur-Bates Communicative Development Inventories (CDI), retrieved from http://wordbank.stanford.edu/analyses?name=item_trajectories (see Frank, Braginsky, Yurovsky, & Marchman, 2016, for more information about Wordbank). By 30 months of age, children have mastered 7 of the regular verbs and 7 of the irregular verbs from the current stimulus set with an accuracy of 90% or above; another 7 of the regular and 8 of the irregular verbs with an accuracy between 80% and 90%; 4 of the regular verbs and 4 of the irregular verbs with an accuracy between 70% and 80%; and 2 of the regular verbs and 1 of the irregular verbs with an accuracy less than 70%.

Table 3 provides a summary of frequency and CDI mastery age for the four conditions. Appendices E and F present the list of the irregular and regular verbs. Sample picture stimuli are shown in Appendix G. In Appendices E and F, the stem-final phonology is also reported and the information was used to classify items into alveolar or non-alveolar depending on the presence of a stem-final /t/ or /d/. No regular verb fell in the alveolar category, whereas 9 irregular verbs did. It had been reported that irregular verbs with stem-final alveolar stop were less likely to have suffixation errors, but were more likely to incur bare stem errors (e.g., Marchman et al., 1999). For example, children may be prone to produce “feed” instead of “feeded” as the past tense form of “feed.” To avoid any bias which might be caused by the imbalance, we compared the datasets with and without the alveolar-stop stimuli in the results section.

Table 3

Means (ranges) of stimulus frequency and CDI mastery information

	Present tense raw F (T)	Present tense raw F (S)	Past tense raw F (T)	Past tense raw F (S)	CDI mastery at 30 months old
RegHi	25.8 (14-86)	8.3 (0-48)	5.5 (0-11)	1.1 (0-5)	0.85 (0.95-0.66)
RegLo	4.9 (3-8)	1.8 (0-6)	1.3 (0-4)	0.2 (0-2)	0.81 (0.94-0.65)
IrregHi	53.5 (25-136)	13.6 (0-32)	10.5 (0-30)	2.5 (0-9)	0.87 (0.71-0.96)
IrregLo	10.6 (1-20)	2.2 (0-8)	4.4 (0-21)	1.2 (0-8)	0.84 (0.67-0.93)

Note. The frequency in this table is obtained from Hall et al. (1984). F = frequency; T = total occurrences; S = occurrences at school; RegHi = regular verbs of high frequency; RegLo = regular verbs of low frequency; IrregHi = irregular verbs of high frequency; IrregLo = irregular verbs of low frequency.

In the current study, we used the following instructions:

"Look at this picture (e.g., point to the picture on the left, where a boy is painting a fence). The boy likes to _____(e.g., paint). Look what he did yesterday (e.g., point to the picture on the right, where the boy is done with painting)! Yesterday he_____(prompt the child to complete the sentence and wait for the child's response)".

If the child did not say the target verb (e.g., "drew" or "fence" instead of "painted"), the examiner reminded the child to use the same word as in the prompt (e.g., "That's good. But remember he likes to paint. Yesterday he_____"). If the child gave a nontarget verb again, the examiner would continue to the next item. A sample response sheet is included in Appendix D.

There were two levels of coding and calculation for the responses in the elicitation task. For the first level, the accuracy of past tense production was determined. A score of 1 was assigned to each standard use of the regular and irregular verbs, and a score of 0 was assigned to an erroneous response. Responses were scored as correct even if there was a verb substitution, as long as the verb was correctly conjugated in past tense (e.g., painted-colored). Variations of past tense forms were also accepted (e.g., drank-drunk; sang-sung). At the second level, we coded the non-target responses by types. In addition to the predicted tense-aspect-related error types (i.e., overregularization, bare stem, stem+ing, double marking, and tense substitution), we observed a few other non-target responses (i.e., negation/emphasis, progressive aspect, gerund), which were related to tense-aspect marking but did not correspond to any of the previously listed error types. We showed the percentages of a particular category depending on the total numbers of responses (with both target and non-target responses as the denominator) or the total number of non-target responses (with only the non-target responses as the denominator). Table 4 provides examples of errors using the regular verb “cook” and the irregular verb “run” as the items.

Table 4

Non-target responses for regular and irregular verbs

Response types	Regular verbs	Irregular verb
Overregularization	---	*Yesterday he runned.*
Bare Stem	*Yesterday he cook.*	*Yesterday he run.*
Negation/Emphasis	*Yesterday he didn't cook./Yesterday he did cook.*	*Yesterday he didn't run./Yesterday he did run.*
Progressive Aspect	*Yesterday he was cooking.*	*Yesterday he was running.*
Gerund	*Yesterday he stopped/finished/(is) done cooking.*	*Yesterday he stopped/finished/(is) done running.*
Stem+ing	*Yesterday he cooking.*	*Yesterday he running.*
Double Marking	---	*Yesterday he ranned/runneded.*
Tense Substitution	*Yesterday he cooks.*	*Yesterday he runs.*
Other Types	(1) saying "*I don't know*"; (2) providing verbs irrelevant to the pictures (e.g., *he laughed* instead of *he cooked*); (3) repeating the prompt (e.g., *he likes to cook*); (4) not using verbs (e.g., *milk* instead of *she poured milk; sad* instead of *he cried*); (5) not giving an answer; (6) not describing a specific action (e.g., *he stopped* instead of *he cooked*).	

Action naming task

The action naming task was developed to measure English verb vocabulary size in the bilingual children and their English monolingual peers. In the current study, action naming accuracy was controlled for in the analyses, because of the possible association

between lexical proficiency (as indexed by action naming) and verb morphological acquisition. Stimuli were 60 transitive and intransitive English verbs and corresponding pictures which depicted the actions. Picture stimuli were selected from the International Picture Naming Project, the IPNP, (http://crl.ucsd.edu/~aszekely/ipnp/, Szekely et al., 2005) and the original black-and-white pictures in IPNP were colored in a computer program prior to being used in the current study. Participants were asked to name the action in each picture. There were 3 practice items. Verbal stimuli are listed in Appendix B. Sample pictures are presented in Appendix C. The examiner gave the following instructions at the beginning of the action naming task:

"You are about to see some pictures on the computer. The pictures will be shown one at a time. Tell me what's happening or what the person is doing in the picture. Say the best name you can think of for the picture."

Action names were counted as correct regardless of the form or context of verb production. For example, we credited target verbs even if they were not inflected correctly (e.g., "readed" instead of "read"). Phrases were also accepted (e.g., "read a book" for "read"). The raw score for accurate naming was recorded.

Reliability

Undergraduate research assistants, who were English native speakers, and the author, who was a Mandarin-English bilingual, transcribed recordings and finished the first-round of coding. Another independent English native speaker, a graduate student, re-coded 20% of the data. Inter-rater agreement was 82.5%. Part of the disagreement was

due to the differences in transcriptions. We propose a statistical method to remedy the differences in the results section.

Chapter Three: Results

PHONOLOGICAL SCREENING TASK AND ACTION NAMING TASK

The percentages of target responses for different language groups in the two control tasks, the phonological screening task and the action naming task, are presented in Table 5. An ANOVA was conducted to investigate whether there was a between-group difference in children's performance on these two tasks.

Table 5

Mean percentages and standard deviations of accuracy in phonological screening and action naming tasks

	ENG		SE		ME	
	M	*SD*	*M*	*SD*	*M*	*SD*
Imitation (%)	98.8	2.8	99.5	2.2	99.8	1.1
Action naming 60 verb set (%)	60.3	12.7	56.7	13.9	56.4	13.0
Action naming 40 verb set (%)	69.6	14.4	67.6	16.8	67.0	15.4

These children from different language backgrounds did not differ in how successfully they imitated the final /t/ and /d/ in the phonological screening task, $F(2, 57) = 1.18$, $p = .32$. All the participants had a success rate of 90% or higher in producing the final consonants /t/ or /d/. Errors included omission of final consonants (e.g., cat-ca; foot-foo), or use of a different word which did not end with /t/ or /d/ (e.g., foot-fumpies). Children from these three groups also had comparable action naming accuracy, $F(2, 57) = 0.53$, $p = .59$. Some of the responses involved a misperception or misinterpretation

error (e.g., shake [a tree]-climb [a tree]; stand-sit; wink-smile; teach-paint; land-fly; catch-throw), or were synonyms of the target answer (e.g., catch [the ball]-get [the ball]; jump-hop; ride-sit on; melt-thaw; chase-run; dive-jump). These responses were not considered correct, as we only accepted the target verb or its inflected forms. Other errors included describing the picture without using the target verb (e.g. dive-the man is touching the water), or giving a noun (e.g., pour-milk). We also calculated the accuracy of the 40 verbs which occurred in both the action naming task and the elicitation task. The accuracy of the 40 verbs was higher than that of the 60 verbs (Table 5).

ELICITATION TASK

Based on the stimulus items included in each dataset, 3 different datasets were developed and compared for overall accuracy on the elicitation task. The first dataset (the complete dataset) contained all 40 stimulus items. In the second dataset (the non-elision set), 7 stimuli involving target verb + (determiner) + noun structure were excluded (i.e., chase the cat; push the stroller; brush his teeth; pour the milk; wash dishes; carry her purses; walk his dog). When linking /t/ and /d/ to another consonant in a determiner (e.g., the, his, her) or an object noun (e.g., dishes, teeth) in the responses, children might only signify /t/ or /d/ by stopping the air, instead of pronouncing the sound for a tense marker. The exclusion of these items was intended to avoid possible miscoding due to the poor intelligibility of these responses. In the third dataset (the non-alveolar set), 9 stimulus verbs ending with /t/ or /d/ were removed (i.e., bite, feed, ride, stand, read, eat, hide, sit, write). Removal of these irregular verb items prevented incurrence of bare stem errors

due to the presence of stem-final alveolar stop. A summary of the datasets is shown in Table 6. An ANOVA was conducted to compare the three datasets. The dependent variable is the average accuracy across all participants (last column). Results indicated no significant set effect, $F(2, 116.92) = 2.07$, $p = .13$.[3] We ran the analyses using the complete dataset hereafter.

Table 6

Mean percentages of correct responses and corresponding standard deviations in the three datasets by language group

	ENG		SE		ME		All participants	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Complete set (%)	40.6	24.2	25.9	20.1	13.6	11.5	26.7	22.0
Non-elision set (%)	36.2	22.5	22.0	18.3	12.6	10.5	23.6	20.1
Non-alveolar set (%)	48.1	26.6	32.1	24.3	16.3	14.4	32.2	25.6

Accuracy

Our first two research questions were related to the overall accuracy. To recapitulate the questions, we asked (1) if there was any bilingual-monolingual difference in the proportions correct of overall English past tense production; and (2) if verb frequency and regularity influenced past tense marking. According to descriptive statistics (See Table 7), children were overall more accurate with regular verbs than

[3] Welch test results were reported because the homogeneity of variances assumption was violated.

irregular verbs. ENG topped the two bilingual groups for the accuracy of regular verbs (n = 260, accuracy = 65%) and irregular verbs (n = 65, accuracy = 16%). Regular verb accuracy was 46% (n =185) for SE and 22% (n = 87) for ME. As for irregular verbs, the two bilingual groups produced the same number of target answers (n = 22), with an accuracy of 6%.

Table 7

The raw number and percentage of correct responses by language groups for different verb types

	ENG		SE		ME	
verb type	n	%	n	%	n	%
RegHi	123	62	86	43	41	21
RegLo	137	69	99	50	46	23
IrregHi	36	18	13	7	16	8
IrregLo	29	15	9	5	6	3

Note. RegHi = regular verbs of high frequency; RegLo = regular verbs of low frequency; IrregHi = irregular verbs of high frequency; IrregLo = irregular verbs of low frequency. The denominator of accuracy proportions for RegHi, RegLo, IrregHi, and IrregLo was 200, the total number of responses elicited from each language group for each verb type.

We ran a binomial logistic hierarchical linear model (HLM) to explore differences in accuracy among the 3 language groups (ENG, SE, ME) across various verb types (regular high, regular low, irregular high, irregular low). HLM allowed us to preserve variations between items and permitted a simultaneous analysis at different levels (item, subject) with respective fixed effects (verb types, language groups). In the 3 (language

group: SE, ME, ENG) x 2 (verb frequency: low, high) x 2 (verb regularity: regular, irregular) mixed model, the dependent variable was the accuracy of children's responses which was coded dichotomously as correct or incorrect. We included all the main effects and the following interactions: language group x verb regularity; language group x verb frequency; verb regularity x verb frequency; language group x verb regularity x verb frequency. In order to control for SES background and language proficiency level, we included maternal education and action naming accuracy as the covariates. There was no significant correlation between maternal education and action naming accuracy (r = -.098, n = 56, p = .47), suggesting multicollinearity was not an issue in the HLM analysis. Table 8 presented the binomial HLM results. The significant main effects or interactions were examined with follow-up tests. The model included a random intercept for subject.

As shown in Table 8, action naming accuracy was a significant predictor, b = 0.12, $F(1, 2{,}226) = 13.51$, $p < .001$, with an odds ratio of 1.12, indicating the likelihood of producing a correct past tense form increased by 12.2% with the increase of one target verb produced in the action naming task. Results also revealed the main effects of regularity and group. Because regularity and group were involved in two significant interactions (frequency x regularity, regularity x group), their effects needed to be interpreted in relation to the other variables involved in the interactions. The frequency x regularity interaction was significant, $F(1, 2{,}226) = 10.02$, $p < .01$. For the high frequency verbs, the regular verbs were more likely than the irregular verbs to be accurate, odds ratio = 11.90. For the low frequency verbs, the regular verbs were more likely than the

irregular verbs to be accurate, odds ratio = 27.55. Furthermore, for the regular verbs, the high frequency verbs were less likely than the low frequency verbs to be accurate, odds ratio = 0.74. For the irregular verbs, the high frequency verbs were more likely than the low frequency verbs to be accurate, odds ratio = 1.72. The other significant interaction involved regularity and group, $F(2, 2{,}226) = 8.82$, $p < .001$. All groups were more likely to be accurate with regular verbs than with irregular verbs: for ENG, odds ratio = 24.68; for SE, odds ratio = 28.41; for ME, odds ratio = 5.68. For regular verbs, both ENG and SE were more likely to be accurate than ME, odds ratios = 9.30 and 3.54; ENG and SE did not differ in their likelihood of accuracy. For irregular verbs, the three groups did not differ from each other.

Table 8

Results of binomial HLM comparing overall accuracy between three language groups across different verb types

Factor	*df* 1	*df* 2	*F*-value	*p*-value
Maternal Education	1	2,226	0.34	.56
Action Naming Accuracy	1	2,226	13.51***	< .001
Frequency	1	2,226	1.06	.30
Regularity	1	2,226	300.44***	< .001
Group	2	2,226	4.13*	< .05
Frequency x Regularity	1	2,226	10.02**	< .01
Frequency x Group	2	2,226	1.25	.29
Regularity x Group	2	2,226	8.82***	< .001
Frequency x Regularity x Group	2	2,226	0.27	.76

An additional binomial HLM was used to compare overall accuracy between the two bilingual groups (SE, ME). The HLM model included the same main effects and interactions which were examined in the previous HLM analysis. In addition to maternal education and action naming accuracy, five additional variables, i.e., child English use, mother English self-rating, father English self-rating, mother English use, and father English use were also considered relevant to past tense use, and thus were included as covariates. Because the total number of desired independent variables in the current HLM

model exceeded the limit in SPSS[4], we added each of the 5 covariates, one at a time, and noted the significant variables. Results showed that only action naming accuracy and child English use were significant [action naming accuracy: $F(1, 1{,}591) = 10.12$, $p = .001$; child English use: $F(1, 1{,}591) = 6.36$, $p < .05$; maternal education: $F(1, 1{,}431) = 0.05$, $p = .82$; mother English self-rating: $F(1, 1{,}551) = 0.78$, $p = .38$; mother English use: $F(1, 1{,}551) = 0.06$, $p = .81$; father English self-rating: $F(1, 1{,}591) = 1.01$, $p = .32$; father English use: $F(1, 1{,}551) = 1.74$, $p = .19$]. Hence these two variables were entered into the final HLM model. Although action naming accuracy and child English use were correlated ($r = .387$, n = 40, $p < .05$), collinearity diagnostics showed that variance inflation factor (VIF) values equaled 1.18, suggesting multicollinearity was not an issue in the current HLM analysis. Results of the HLM model are shown in Table 9.

[4] SPSS (version 21.0) allows only 10 independent variables (including main effects and interactions) in one HLM model.

Table 9

Results of the binomial HLM comparing overall accuracy between two bilingual groups across different verb types

Factor	*df* 1	*df* 2	*F*-value	*p*-value
English Use	1	1,590	2.55	.11
Action Naming Accuracy	1	1,590	6.33*	< .05
Frequency	1	1,590	1.50	.22
Regularity	1	1,590	168.38***	< .001
Group	1	1,590	0.81	.37
Frequency x Regularity	1	1,590	7.29**	< .01
Frequency x Group	1	1,590	1.30	.25
Regularity x Group	1	1,590	17.33***	< .001
Frequency x Regularity x Group	1	1,590	0.30	.59

As can be seen in Table 9, overall accuracy in bilingual groups was predicted by action naming accuracy, $b = 5.11$, $F(1, 1{,}590) = 6.33$, $p < .05$. The odds ratio of 1.09 indicated that there was an 8.9% increase in the odds of producing a target past tense form for each additional accurate response in the action naming task. Two significant 2-way interactions were revealed. The frequency x regularity interaction was significant, $F(1, 1{,}590) = 7.29$, $p < .01$. For high frequency verbs, the regular verbs were more likely than irregular verbs to be accurate, odds ratio = 9.52. For low frequency verbs, the regular verbs were more likely than irregular verbs to be accurate, odds ratio = 27.38. For

regular verbs, the high frequency and low frequency verbs did not differ from each other. For irregular verbs, the high frequency verbs were more likely than the low frequency verbs to be accurate, odds ratio = 2.17. The significant regularity x group interaction, $F(1, 1{,}590) = 17.33$, $p < .001$, indicated similar patterns as those found in the HLM for the three language groups. Specifically, both groups were more likely to be accurate with regular verbs than with irregular verbs; for SE, odds ratio = 35.15; for ME, odds ratio = 5.65. For regular verbs, SE was more likely to be accurate than ME, odds ratios = 3.40. For irregular verbs, SE and ME did not differ in their likelihood of accuracy.

Error Patterns

The third research question asked whether error patterns were similar across the three language groups. Table 10 demonstrated a raw count of different non-target response types by the 3 language groups, as well as proportion values obtained from the frequency of each non-target response type divided by the total number of non-target responses in each language group. Appendix H provided a further breakdown by regularity and frequency.

Table 10

The raw number and proportion of different error types and language group

	ENG		SE		ME	
	n	%	n	%	n	%
Overgeneralization	112	23.6	89	15	35	5.1
Bare stem	258	54.3	299	50.4	521	75.40
Negation/Emphasis	37	7.8	49	8.3	1	0.1
Progressive aspect	1	0.2	3	0.5	1	0.10
Gerund	1	0.2	12	2	40	5.8
Stem+ing	2	0.4	2	0.3	3	0.40
Double marking	3	0.6	2	0.3	0	0
Tense substitution	0	0	9	1.5	3	0.40
Other types	61	12.8	128	21.6	87	12.6

Note. The denominator of error type proportion was the total number of errors produced by children from each language group for regular verbs (ENG: n = 475; SE: n = 593; ME: n = 691).

Overall, bare stem was the most common error type for the three language groups (54% for ENG; 50% for SE; 75% for ME). For ENG, overregularization was the second most common errors (24%). For SE, overregularization occurred less frequently (15%) than either bare stem (51%) or other types of errors (22%), but ranked the second most common errors among irregular verb errors (24%) (See Appendix H). For ME, overregularization only accounted for a small portion of errors (9% of irregular verb errors, or 5% of all errors). In addition to the findings related to bare stem and

overregularization, the number of negation/emphasis responses was higher than any tense-related errors other than overregularization and bare stem for both ENG and SE, whereas the number of gerunds surpassed that of overregularization among all errors produced by ME. Close examinations of the data showed that all the negation/emphasis responses were exclusively made by one participant in ENG. Negation/emphasis responses were distributed among 4 Spanish-English bilingual children: one child produced 15 negation/emphasis responses, another child 14 negation/emphasis responses, and the rest two children each produced 10 responses of this type. There were 4 Mandarin-English bilingual children who produced a total of 40 gerunds and one of the children produced 31 out of all the gerund responses.

A binomial HLM was conducted to examine the third research question pertaining to error patterns. The dichotomous dependent variable had two possible values: overregularization and bare stem. These two error types were of primary interest in the analysis because the generation of these two error types might be influenced by different L1 backgrounds. Furthermore, due to few observations in some error categories, running HLM across all the 9 error types in SPSS resulted in a model that did not converge and was thus uninterpretable. Therefore, only overregularization and bare stem were included in the current analysis. The main effect of language group was included in the model. Maternal education and action naming accuracy were included as covariates. The model also included a random intercept for subject.

Table 11 presents the results of the binomial HLM comparing the two error types across language groups. Results confirmed the significant group difference in error types, $F(2, 1{,}236) = 9.991$, $p < .001$. Compared with ME, both ENG and SE had a much higher odds of producing overregularization errors relative to zero-marking past tense (ENG versus ME: $p < .001$, odds ratio = 7.72; SE versus ME: $p < .001$, odds ratio = 5.49). ENG and SE did not differ in the likelihood of making overregularization errors versus bare stem errors ($p = .48$).

Table 11

Results of the binomial HLM comparing overregularization and bare stem across different language groups

Factor	*df* 1	*df* 2	*F*-value	*p*-value
Maternal Education	1	1,236	0.02	.90
Action Naming Accuracy	1	1,236	2.77	.10
Group	2	1,236	9.99***	< .001

Summary

To summarize, ME were less accurate at producing English past tense than either ENG or SE. The group effect on overall accuracy, however, was moderated by verb regularity, with comparable odds of being accurate among all three language groups for irregular verbs. There was also a group difference in error patterns. Compared with ME, ENG and SE were more likely to make overregularization errors versus bare stem errors.

Chapter Four: Discussion

The current research focused on the cross-linguistic influences in the acquisition of English past tense in young bilingual children. To achieve the main goals of this study, we (1) developed a set of age-appropriate stimuli in which frequency and regularity of verbs were manipulated; (2) evaluated past tense accuracy in 3-4-year-old SE and ME, as well as age-matched ENG; and (3) coded different types of errors produced by learners in the three language groups. Consistent with some of our predictions, the overall accuracy of English past tense morphology was affected by monolingual and bilingual status, verb regularity, and lexical proficiency. In addition, error patterns differed across language groups. Here we discuss these effects and how cross-linguistic influence contributed to acquisition of verb morphology in bilingual children.

INFLUENCE OF LANGUAGE BACKGROUND

Difficulty in past tense morphological marking is common to young monolingual children as manifested by their protracted acquisition of tense marking. The challenge may be even greater for bilingual children. We observed differences and similarities in English past tense marking across the language groups. First, ENG and SE did not differ statistically in their overall English tense marking. Previous research reported delays in past tense marking in bilingual children (e.g., Chondrogianni & Marinis, 2012; Davison & Hammer, 2012; Paradis et al., 2011; Nicholls et al., 2011), partly due to the divided language use (Tomasello, 2003). In the current study, however, the performance of SE in the elicitation task resembled that of ENG, despite less than 60% English use in SE,

relative to near 100% English use in their monolingual peers. Positive transfer from Spanish to English may contribute to such a bilingual-monolingual similarity. Our results also showed that ME had an overall low accuracy level of past tense marking than either of the other two groups. Although the three language groups had comparable action naming accuracy and the two bilingual groups had similar English use amounts, the inferior performance of ME in past tense marking emerged. This finding is consistent with Brebner et al. (2016) which indicated that bilingual Singaporean kindergarteners, after about 3 years' exposure to Standard English in the school setting, still rarely produced tense markers. The authors argued that the influence of Mandarin instead of language dominance or language experience accounted for the omission of tense marking.

Some studies, however, found evidence which ran counter to the claim that there is such a bilingual lag even at an early age. For example, Paradis and Genesee (1996) suggested simultaneous 2-year-old bilinguals were as accurate as age-matched monolinguals in the acquisition of finiteness, negation, and pronominal subjects. There could be three possible reasons for the discrepant findings. One possibility is that acquisition of different morphosyntactic categories may vary in rate and pattern, and that bilingual children may not lag behind monolinguals of the same age in all categories (e.g., Paradis et al., 2011). A second possibility may lie in the variation in both quality and quantity of participants' language input. The three French-English bilingual children in Paradis and Genesee (1996) were raised by the "one parent one language" strategy

from birth at home, and their parents were native speakers of English or French. In contrast, most participants in our study grew up in families in which parents were not English native speakers, and the primary home language was Spanish or Mandarin for the majority of participants.

Another possibility is related to the nature of data collection procedures. Paradis and Genesee (1996) analyzed conversations in naturalistic parent-child play sessions, where children might only use a small number of very familiar past tense forms and avoid verbs for which they were not confident about the past tense forms. Our study employed an elicitation task which covered a variety of common verbs to children. Children were prompted to produce these target verbs in their past tense. An advantage of elicited production is that we were able to test some verbs that rarely occur in children's spontaneous speech because of situations and children's experience (Crain & Thornton, 2000).

A second finding is that the two bilingual groups seemed to be comparable in overall accuracy in past tense marking (no main effect of group in the SE-ME comparison, see Table 9). This finding was unsurprising and echoed the usage-based accounts of language development, which propose that variation in exposure to English could influence bilingual children's accuracy of past tense production (e.g., Tomasello, 2003; Gathercole, 2007). In consonance with our main research objective of examining the effect of cross-linguistic influence, we endeavored to reduce the effects of other factors which impact English past tense acquisition. The language use amount is one of

these factors and thus was controlled for by study design. Both SE and ME had systematic English exposure starting no later than 2 years old, and their current English use did not differ. The comparable experience with English may account for their similar overall accuracy in past tense marking. The similarity in language use may also explain why child English amount was not an informative indicator of grammatical morpheme accuracy.

An alternative but not exclusive explanation of the similarity in accuracy between the two bilingual groups is linked with the influence from L1 to L2. For SE, a positive cross-linguistic influence (e.g., MacWhinney, 2005) may facilitate regular past tense marking in English, but at the same time may also increase the likelihood of producing overregularization errors for irregular verbs. In a similar vein, ME may be vulnerable to omitting a regular past tense marker because they still need to map the concept of tense with the grammatical marker, whereas they may be spared from overregularizing irregular verbs. Indeed, our findings revealed that SE group on average produced a larger number of overregularization errors than ME group. Note that SE children outperformed ME children in regular past tense marking. The group x regularity interaction is further discussed in the following section regarding the effect of regularity.

It is worth mentioning that SE received higher English proficiency ratings in comparison with ME. The parental reports were not commensurate with results of comparable action naming accuracy and past tense marking accuracy between the two bilingual groups. This discrepancy may be relevant to higher English self-rating and

greater use of English by SE bilinguals' mothers. They may feel more comfortable speaking English with their children relative to ME's mothers, and thus better understand their children's language development. Some ME's parents reported that they rarely spoke to their children in English, and some acknowledged that they had heard their children speak English on only a few occasions. The divergence between parental reports and experimental results is also in agreement with previous findings (e.g., Sheng, Lu, & Gollan, 2014).

The most striking observation pertains to error type production and provides the strongest evidence for cross-linguistic influence. ENG children and SE children were more likely to produce overregularization errors and less likely to produce bare stems relative to their ME peers. ENG children and SE children did not differ in error patterns. These findings corroborate the role of the cross-linguistic influence in English past tense marking. Overregularization suggests the process of learning and applying the rule of regular past tense marking. SE children were on par with ENG children regarding the odds of making overregularization errors, perhaps due to the availability of inflectional morphemes in their L1 (Spanish). In the same vein, ME children produced more bare stem errors in comparison with overregularization errors than ENG children and SE children, probably because of the absence of grammaticalized tense markers in their L1 (Mandarin). The influence of L1 inflectional morphology, or the lack of inflectional markers in L1, on L2 morpheme acquisition was also depicted in the morphological congruency hypothesis (Jiang, Novokshanova, Masuda, & Wang, 2011). The hypothesis

proposes that when a grammatical morpheme is present in L2 but not L1 (i.e., morphologically incongruent), L2 learners may encounter considerable difficulty in attaining native-like proficiency in their second language.

To better understand cross-linguistic influences, it is important to go beyond the question of whether there are interactions between bilinguals' two languages and to identify what is transferred in the interactions. Morphosyntactic forms are unique to each language and thus may not transfer across languages (MacWhinney, 2005). However, the function of linguistic forms is to convey meanings, and semantic features may be shared between the two languages in bilingual children (Paradis et al., 2011). Therefore, bilinguals' two languages may interact at the interface of form and meaning (e.g., Gathercole, 2007). Specifically, in the current research, the exact Spanish past tense marker was not involved in the influence of L1 on the acquisition of English past tense in SE children. Rather, the common notion of obligatorily inflecting verbs in a certain way between Spanish and English may have enabled SE children to generalize the grammatical rules of English past tense marking more easily than ME children.

INFLUENCE OF FREQUENCY, REGULARITY, AND VERB VOCABULARY

Our second research question asked whether frequency and regularity influence past tense production in both monolingual and bilingual children. These verb features are associated with the morphosyntactic acquisition and language processing (e.g., Ellis, 2002; Bybee, 2003) and are relevant to our research topic of past tense acquisition in bilingual children. Because the frequency of individual verbs in past tense contributes to

the acquisition of verb morphology, tense morphology accuracy may vary across high and low frequency verbs. By different learning strategies, regular and irregular past tense production may challenge bilingual children, who come from diverse L1 backgrounds, in different ways.

Our prediction regarding verb frequency was partially borne out by the data. We anticipated that children would be more accurate with high frequency targets than low frequency ones. Results revealed no main effect of frequency. However, there was an interaction between frequency and regularity. Regular and irregular verbs seem to have opposite trends with respect to the influence of frequency. Children tended to produce high frequency irregular verbs in past tense more accurately than low frequency irregular verbs, whereas the pattern was reversed for regular verbs. This discrepancy may be related to the rule-based learning strategy involved in regular past tense marking and the item-based learning strategy in irregular past tense. The participants in the current study were likely to have passed the stage of solely memorizing the past tense forms of single regular verbs. They were able to generalize the grammatical rule of pass tense marking and widely apply it to a variety of verbs, regardless of their frequency. In contrast, irregular verb forms do not follow a certain conjugation rule and the production of these forms largely depends on rote memorization. Even though a few irregular past tense forms share some similarities in their inflections (e.g., sing-sang vs. ring-rang; take-took vs. shake-shook), such irregular inflection exemplars are sporadic and on many occasions inconsistent (e.g., take-took vs. make-made). Alternatively, the counter-intuitive finding

regarding regular verbs' sensitivity towards frequency may be related to the familiarity of the verbs. Despite the difference in their frequency reported in Hall et al. (1984), all the regular verbs were very early acquired and familiar to participants and thus posed no difficulty to children's use of their past tense forms. These interpretations may be tested by including novel verb stimuli in future studies.

Our prediction regarding the effect of regularity was supported by the findings. Children were on average more accurate with regular verbs than irregular verbs. The interaction between regularity and group provided further insight into the cross-linguistic influence. ENG children and SE children were more likely than ME children to produce accurate responses for regular verbs than irregular verbs. This difference in the odds of accuracy between groups seems to be related to ME's stronger tendency to not mark regular verbs relative to ENG and SE, and ME's reduced tendency to overregularize irregular verbs. Note that the three groups had similar action naming accuracy and the two bilingual groups also had comparable English use amounts. Perhaps the fact that the ME group was not as sensitive to regular verb marking rules as the other two groups caused their lower accuracy overall for regular verbs, but meanwhile also exempted them from overregularization errors in irregular verbs. SE children demonstrated the same pattern as ENG children, probably due to the availability of inflectional tense morphemes in Spanish. On the contrary, ME children demonstrated a different pattern because of no morphosyntactic basis for cross-linguistic influence in Mandarin.

One of our findings regarding the role of verb vocabulary in English past tense marking is less directly related to cross-linguistic influence than other effects but was worth noting. Overall, action naming accuracy was a robust significant predictor of English past tense accuracy. This finding is in keeping with the extant literature on the lexicon-grammar relationship (e.g., the critical mass hypothesis, Marchman & Bates, 1994). Nonetheless, our findings also suggested that similarity in verb vocabulary did not guarantee equal performance in past tense marking. It may be because lexical development is a precursor to morphological development (e.g., the critical mass hypothesis). The acquisition of verbal morphology is multifaceted and may require a prolonged time before bilingual children attain high accuracy in English past tense marking.

IMPLICATIONS FOR CLINICAL ASSESSMENT

Our study has implications for bilingual language assessment. Morphology is one of the language domains which is most likely to be affected in monolingual and bilingual children with language impairment (e.g., Marchman et al., 1999; Verhoeven, Steenge, & van Balkom, 2011). As a result, speech-language pathologists need to understand variation in morphological production by children from different language backgrounds, in order to reliably assess and provide intervention for these populations. Accuracy rate and error patterns regarding verb morphology may be effective tools for language assessment (e.g., Bedore, 2001).

We reported that typically-developing children from different linguistic backgrounds showed various accuracy levels in the acquisition of English past tense. As a group, ENG outperformed their bilingual peers and produced past tense forms more accurately. This finding highlights the caution needed in using monolingual normative data on English past tense use when assessing different bilingual populations with less English exposure. Acknowledging the influence of L1 leads to better understanding of differences in language use and may avoid misdiagnosis of a language disorder. Furthermore, our work also gives rise to the need to expand the investigation of verb morphology development in bilingual populations. Other bilingual populations may also vary in their performance. Without sufficient data from a particular bilingual population, we are unable to establish reliable diagnostic standards.

Our research further revealed that the groups diverged in past tense error patterns as well. In particular, ME tended to unmark English past tense relative to children in the other two language groups. Overuse of bare stems had been found to be a red flag for language impairment for Spanish-English bilingual and English monolingual children (e.g., Jacobson & Schwartz, 2005; Marchman et al., 1999; Rice, Wexler, & Cleave, 1995). However, it may be inappropriate to interpret error data in the same way in bilingual language assessment. We need to distinguish difficulty in tense inflection because of bilingual backgrounds from the vulnerability of misusing target morphological markers due to language impairment (e.g., Paradis, Rice, Crago, & Marquis, 2008; Jia &

Fuse, 2007). Only in this way can we accurately assess language impairment in bilinguals with diverse linguistic backgrounds.

LIMITATIONS

This study may be improved by addressing the following issues: First, Both SE and ME may reduce consonant clusters and consequently produce bare stem errors (e.g., walked-walk, climbed-climb). The effect of phonetic constraints may be attributed to influence from their L1 (Spanish or Mandarin). Spanish allows a limited number of consonant clusters which do not occur in the final position, and Mandarin has no consonant clusters. Although SE were less likely to produce bare stem errors than ME despite this possible influence, identifying any influences of cluster reduction may further help us understand how L1 influences L2. Future studies may include stimulus words containing consonant clusters in the phonological screening task, in order to determine the degree to which phonological transfer contributes to the production of bare stem errors.

We followed some previous studies (e.g., Marchman et al., 1999) and employed word occurrences in Hall et al. (1984) to classify high frequency and low frequency words. The effect of frequency was not pronounced. On the one hand, although the target verbs selected in the current study were highly familiar to children from a normative perspective, the accuracy of producing these verbs in the action naming task was relatively low (< 70%). On the other hand, the range of frequency for regular or irregular verbs was broad. Therefore, using medians as cutoff values may not reflect an accurate

distinction between high frequency and low frequency. To mitigate these concerns, we may ask parents or teachers to rate the familiarity of the stimulus verbs. In addition, we can develop a set of novel verbs which resemble the formation of existing regular or irregular verbs (e.g., Jacobson & Schwartz, 2005).

We used an action naming task to measure verb vocabulary in the present study. Among the 60 targets in the action naming task, 40 items were also included in the elicitation task. Because the elicitation task was always administered prior to the action naming task, action naming accuracy might be affected by the task order. To address this issue, these two tasks may be given to participants on two different days with an interval of at least 2 days.

Moreover, there are some other important item features which are associated with tense inflection. For example, neighborhood structures (e.g., "break" and "make" are phonological neighbors) have been found to play a role in English past tense marking (Marchman et al., 1999). Lexical aspect of verbs (e.g., telicity) also has an impact on past tense marking. Because they are not the primary focus of the current study, we did not include them in the current investigation. Notwithstanding its limitations, this study does reveal a contribution of L1 morphology to English past tense marking.

FUTURE WORK

Future research may take the following directions. First, cross-sectional studies and longitudinal studies may be developed to explore how variations in language experience and change of language dominance may affect English past tense use. In the

current study, the parents of ME reported higher ratings for their children's Mandarin than the parents of SE for their children's Spanish. We did not objectively measure bilingual children's L1 proficiency. However, it is possible that the proficiency of SE bilinguals' Spanish would exceed that of ME bilinguals' Mandarin in the long term. About 14 SE were enrolled in bilingual schools or L1 immersion programs, whereas only 4 ME bilinguals attended a 2-hour weekend Chinese school. This stronger community support for Spanish may also enable SE to maintain their L1 at a higher level and for a longer period of time. The continuing use of Spanish may consequently slow down the process of SE's shifting to English dominance. In contrast, ME may become English dominant as early as 4-5 years old (Sheng, Lu, & Kan, 2011). As the influence from Mandarin on English tense morphology may be alleviated with language dominance shift, the bilingual–monolingual gap in overall accuracy and the difference in error patterns will greatly diminish or even disappear.

Second, future investigation may expand on this study by examining the influence from English to L1. For example, Spanish production may be collected from SE and their Spanish monolingual counterparts. Comparison of the use of Spanish preterite forms may inform us of a possible bidirectional relationship, which may help us further understand interactions between language systems in bilingual children.

Appendix A: Stimuli for Phonological Screening Task

	/t/	/d/
1	bat	bed
2	cat	cloud
3	foot	bird
4	ant	hand
5	heart	gold
6	plate	bread
7	belt	bride
8	tent	sand
9	boat	food
10	hat	mud

Appendix B: Stimuli for Action Naming Task

3 practice items

1. sleep; 2. paint; 3. smell

60 stimulus verbs

1. cook; 2. eat; 3. feed; 4. read; 5. ride; 6. run; 7. sing; 8. sit; 9. splash; 10. blow; 11. walk; 12. cry; 13. dance; 14. shake; 15. drink; 16. carry; 17. play; 18. push; 19. chase; 20. jump; 21. smile; 22. swim; 23. climb; 24. wash; 25. brush; 26. drive; 27. knock; 28. kick; 29. stand; 30. fall; 31. talk; 32. write; 33. lick; 34. pour; 35. pull; 36. bite; 37. hide; 38. give; 39. swing; 40. throw; 41. point; 42. serve; 43. catch; 44. teach; 45. bake; 46. call; 47. dive; 48. rain; 49. fly; 50. bounce; 51. melt; 52. kiss; 53. clap; 54. wink; 55. suck; 56. boil; 57. land; 58. cut; 59. dip; 60. listen.

Appendix C: Sample Action Naming Task Picture Stimuli

Appendix D: Elicitation Task Response Sheet

Opening Remarks: "I have two pictures. I will describe the first one and you tell me about the second one. Let's try"

Practice: "Look at this picture (point to the picture on the left, where a boy is painting). The boy likes to paint. Look what he did yesterday (point to the picture on the right, where the boy is done with painting)! Yesterday he_____(prompt the child to complete the sentence and wait for the child's response)".
If the child gives the correct answer (i.e., painted), the researcher will show the next set of pictures and say "Very good! Let's look at more pictures."
If the child fails to give the (e.g., paints/paint), the researcher will say "That's good. But remember he did that ***yesterday***. Can you say yesterday he painted?" After the child repeats "Yesterday he painted", the researcher will show the next practice pictures and say, "Very good! Let's look at other pictures."
If the child gives a non-target answer (e.g., color), the researcher will say "That's good. But remember he likes to ***paint***. Can you say yesterday he painted?" After the child says "Yesterday he painted", the researcher will show the next practice pictures and say, "Very good! Let's look at other pictures."

Task Introduction: "You are going to see some new pictures. I will describe the first one, and I want you to tell me about the second one, just like what you just did. I want you to give me the best answer you can think about. Now let's begin."
For the testing trials, if the child answers with a different verb (e.g., "cleaned his teeth" instead of "brush his teeth"), the examiner will remind the child of using the same word in the prompt (e.g., "That's good. But remember he likes to ***brush*** his teeth. Yesterday he_____"). If the child gives a nontarget answer again, the examiner will go on without further comment.

Note. Circle "verb stem", if the child produces the target verb without any inflection (e.g., paint-paint; fly-fly). Circle "verb-ed", if the child produces the target verb which is correctly inflected in past tense (e.g., paint-painted; fly-flied). For irregular verbs, circle the target inflected forms, if the child produces correct answers. Circle "verb-ing", if the child produces the target verb which is in the –ing form (e.g., paint-painting; fly-flying). Circle "other answer" and record the child's answers on the lines next to "other answer", if the child gives anything other than the above answer types (e.g., paint-paints/paint the fence/painted the fence/color; fly-flies/fly the plane/flight/land/airplane). Circle "NR" if the child doesn't respond. Circle "DK" if the child says "I don't know."

Practice item

1. The boy likes to **paint**. Look what he did yesterday! Yesterday he _____
   verb stem verb-ed verb-ing other answer_____ NR DK
2. The boy likes to **fly**. Look what he did yesterday! Yesterday he _____
   verb stem verb-ed verb-ing other answer_____ NR DK
3. The frog likes to **kiss**. Look what she did yesterday! Yesterday she _____

verb stem verb-ed verb-ing other answer_____ NR DK

4. The teacher likes to **teach**. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK

Testing item

1. They like to splash. Look what they did yesterday! Yesterday they _____
verb stem verb-ed verb-ing other answer_____ NR DK
2. The boy likes to brush his teeth. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK
3. The boy likes to write. Look what he did yesterday! Yesterday he _____
verb stem verb-ed wrote verb-ing other answer_____ NR DK
4. The baby likes to stand. Look what he did yesterday! Yesterday he _____
verb stem verb-ed stood verb-ing other answer_____ NR DK
5. The girl likes to throw. Look what she did yesterday! Yesterday she _____
verb stem verb-ed threw verb-ing other answer_____ NR DK
6. The girl likes to fall in the snow. Look what she did yesterday! Yesterday she _____
verb stem verb-ed fell verb-ing other answer_____ NR DK
7. The boy likes to hide. Look what he did yesterday! Yesterday he _____
verb stem verb-ed hid verb-ing other answer_____ NR DK
8. They like to play. Look what they did yesterday! Yesterday they _____
verb stem verb-ed verb-ing other answer_____ NR DK
9. The girl likes to swim. Look what she did yesterday! Yesterday she _____
verb stem verb-ed swam verb-ing other answer_____ NR DK
10. The boy likes to kick. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK
11. The girl likes to give gifts. Look what she did yesterday! Yesterday she _____
verb stem verb-ed gave verb-ing other answer_____ NR DK
12. The boy likes to drive. Look what he did yesterday! Yesterday he _____
verb stem verb-ed drove verb-ing other answer_____ NR DK
13. The dog likes to chase the cat. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK
14. The boy likes to sit. Look what he did yesterday! Yesterday he _____
verb stem verb-ed sat verb-ing other answer_____ NR DK
15. The girl likes to feed squirrels. Look what she did yesterday! Yesterday she _____
verb stem verb-ed fed verb-ing other answer_____ NR DK
16. The girl likes to cook. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK
17. Mommy likes to push the stroller. Look what she did yesterday! Yesterday she __
verb stem verb-ed verb-ing other answer_____ NR DK
18. The girl likes to drink. Look what she did yesterday! Yesterday she _____
verb stem verb-ed drank verb-ing other answer_____ NR DK
19. The boy likes to eat. Look what he did yesterday! Yesterday he _____
verb stem verb-ed ate verb-ing other answer_____ NR DK

20. The boy likes to jump. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK
21. The boy likes to read. Look what he did yesterday! Yesterday he _____
verb stem verb-ed read(/red/) verb-ing other answer_____ NR DK
22. The dog likes to shake. Look what he did yesterday! Yesterday he _____
verb stem verb-ed shook verb-ing other answer_____ NR DK
23. The girl likes to run. Look what she did yesterday! Yesterday she _____
verb stem verb-ed ran verb-ing other answer_____ NR DK
24. The cat likes to lick. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK
25. The boy likes to ride. Look what he did yesterday! Yesterday he _____
verb stem verb-ed rode verb-ing other answer_____ NR DK
26. They like to talk on the phone. Look what they did yesterday! Yesterday they ___
verb stem verb-ed verb-ing other answer_____ NR DK
27. The boy likes to blow candles. Look what he did yesterday! Yesterday he _____
verb stem verb-ed blew verb-ing other answer_____ NR DK
28. Mosquitoes like to bite. Look what they did yesterday! Yesterday they_____
verb stem verb-ed bit verb-ing other answer_____ NR DK
29. The man likes to climb. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK
30. The girl likes to pour milk. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK
31. The girl likes to dance. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK
32. The boy likes to knock on the door. Look what he did yesterday! Yesterday he __
verb stem verb-ed verb-ing other answer_____ NR DK
33. The girl likes to swing. Look what she did yesterday! Yesterday she _____
verb stem verb-ed swang verb-ing other answer_____ NR DK
34. The girl likes to sing. Look what she did yesterday! Yesterday she _____
verb stem verb-ed sang verb-ing other answer_____ NR DK
35. The girl likes to smile. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK
36. The girl likes to wash dishes. Look what she did yesterday! Yesterday she _____
verb stem verb-ed verb-ing other answer_____ NR DK
37. The baby likes to cry. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK
38. The girl likes to pull the wagon. Look what she did yesterday! Yesterday she ___
verb stem verb-ed verb-ing other answer_____ NR DK
39. The girl likes to carry her purses. Look what she did yesterday! Yesterday she __
verb stem verb-ed verb-ing other answer_____ NR DK
40. The boy likes to walk his dog. Look what he did yesterday! Yesterday he _____
verb stem verb-ed verb-ing other answer_____ NR DK

Appendix E: Item characteristics of irregular verbs

Item	F	Present tense raw F (total)	Present tense raw F (school)	Past tense raw F (total)	Past tense raw F (school)	Stem-final alveolar stop	CDI mastery at 30 months old (%)
Bite	L	12	2	20	4	Yes	90
Drink	L	20	3	1	0	No	93
Drive	L	1	1	0	0	No	85
Feed	L	12	0	0	0	Yes	75
Fall	L	17	4	21	8	No	93
Ride	L	17	1	1	0	Yes	86
Shake	L	7	1	1	0	No	67
Stand	L	15	8	0	0	Yes	77
Swim	L	2	0	0	0	No	87
Swing	L	3	2	0	0	No	89
Blow	H	29	5	4	1	No	86
Read	H	30	1	30	1	Yes	92
Eat	H	99	19	26	9	Yes	96
Give	H	136	32	20	6	No	79
Hide	H	36	29	0	0	Yes	82
Run	H	48	8	5	1	No	93
Sing	H	35	0	0	0	No	88
Sit	H	46	14	1	0	Yes	92
Throw	H	51	21	12	6	No	88
Write	H	25	7	7	1	Yes	71

Note. F = frequency; L = low frequency; H = high frequency

Appendix F: Item characteristics of regular verbs

Item	F	Present tense raw F (total)	Present tense raw F (school)	Past tense raw F (total)	Past tense raw F (school)	Stem-final alveolar stop	CDI mastery at 30 months old (%)
Carry	L	8	1	2	0	No	82
Chase	L	7	6	4	0	No	65
Climb	L	6	3	1	0	No	81
Cook	L	3	1	2	0	No	81
Cry	L	5	3	0	0	No	94
Dance	L	5	1	0	0	No	92
Kick	L	4	0	3	2	No	88
Lick	L	5	0	0	0	No	70
Smile	L	3	2	0	0	No	73
Splash	L	3	1	1	0	No	84
Brush	H	24	0	1	0	No	92
Jump	H	22	5	11	5	No	94
Knock	H	17	6	6	2	No	79
Play	H	86	48	8	0	No	95
Pour	H	17	4	0	0	No	66
Pull	H	14	2	6	1	No	76
Push	H	15	11	11	1	No	84
Talk	H	24	3	1	1	No	81
Walk	H	25	2	4	1	No	91
Wash	H	14	2	7	0	No	90

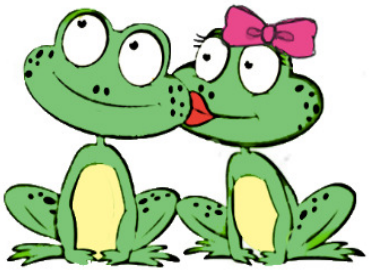
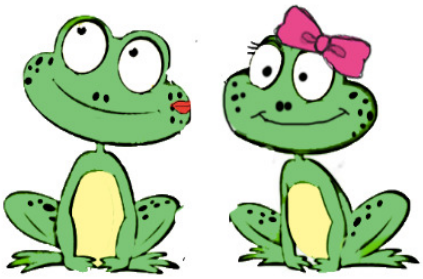
Note. F = frequency; L = low frequency; H = high frequency

Appendix G: Sample Elicitation Task Picture Stimuli







Appendix H: The raw number (percentage) of different non-target responses by frequency, regularity and language group

	Regular High			Irregular High			Regular Low			Irregular Low		
	ENG	SE	ME	ENG	SE	ME	ENG	SE	ME	ENG	SE	ME
	N	N	N	N	N	N	N	N	N	N	N	N
Overregularization	0(0)	0(0)	0(0)	49(30)	38(20)	15(8)	0(0)	0(0)	0(0)	63(37)	51(27)	20(10)
Bare Stem	49(64)	54(47)	126(79)	91(55)	107(57)	137(74)	38(60)	51(50)	116(75)	80(47)	87(46)	142(73)
Negation/Emphasis	10(13)	17(15)	0(0)	10(6)	4(2)	0(0)	9(14)	15(15)	1(1)	8(5)	13(7)	0(0)
Progressive Aspect	0(0)	2(2)	0(0)	0(0)	0(0)	0(0)	0(0)	1(0)	1(1)	1(1)	0(0)	0(0)
Gerund	0(0)	3(3)	13(8)	0(0)	4(2)	6(3)	1(2)	5(5)	11(7)	0(0)	0(0)	10(5)
Stem+ing	1(1)	0(0)	1(1)	0(0)	2(1)	1(1)	1(2)	0(0)	1(1)	0(0)	0(0)	0(0)
Double Marking	0(0)	1(1)	0(0)	1(1)	0(0)	0(0)	1(2)	1(1)	0(0)	1(1)	0(0)	0(0)
Tense Substitution	0(0)	1(1)	0(0)	0(0)	3(2)	3(2)	0(0)	1(1)	0 (0)	0(0)	4(2)	0(0)
Other Types	17(22)	36(32)	19(12)	13(8)	29(16)	22(12)	13(21)	27(27)	24(16)	18(11)	36(19)	22(11)
Total	77	114	159	164	187	184	63	101	154	171	191	194

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